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Participatory Continuing Design: “Living with” videoconferencing in rehabilitation

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Abstract. While much research emphasizes design-before-use, we here study design-in-use. The notion of participatory continuing design is introduced to draw attention to the ongoing work of incorporating information and communication technology into work processes in healthcare institutions. Through an empirical case study of how telemedicine, in the form of videoconferencing, was taken up in a rehabilitation hospital in Norway, the nature of such ongoing experimentation, learning, and redesign is described. When contrasted with traditional design-before-use practices, participatory continuing design differs in terms of its timing, object, process, outcome, and participants. We offer recommendations for how such processes can be supported in healthcare organizations.

Keywords. Participatory design, design in use, configuring practice, healthcare

Introduction

Information and communication technology (ICT) holds the potential to improve healthcare, yet exploiting this potential poses considerable challenges [1]. We contend that one of the main challenges concerns the incorporation of already existing technologies into the work processes of the healthcare organization. Many of these technologies exist not only outside but also inside the healthcare organization. They are in use but their use is limited by unresolved usage problems, unchanged work processes, partial adoption among the healthcare professionals, and so forth. While the technologies are designed artifacts, the designing of their situated use in the healthcare organization is still ongoing. This study explores the continuing, user-driven, participatory process of working on completing the design of healthcare information systems after they have entered into ordinary use. We term this process participatory continuing design.

Participatory continuing design targets design in use [2, 3, 4] rather than design before use. This focus has consequences beyond the temporal shift to a later phase in the system lifecycle. We will outline these consequences by contrasting participatory continuing design with participatory design (PD) processes that target design before use. To illustrate the work involved in participatory continuing design we analyze a

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case about the implementation of telemedicine, in the form of videoconferencing, in a Norwegian hospital. The hospital specializes in rehabilitation and serves patients from all over Norway. For most of the patients, the initial hospitalization is followed by a long-term relation to the hospital for follow-up treatment, new assessments of rehabilitation potential and the like. The hospital started experimenting with videoconferencing in 1993 and since 2010 it has been in hospital-wide use to minimize travel for patients, caregivers external to the hospital, or both. Our empirical material about the case has been collected on multiple occasions during the period 2006-2015. This longitudinal involvement in the case enables us to analyze how the use of videoconferencing has evolved through a continuing series of PD incidents.

This paper aims to characterize participatory continuing design, set it apart from design before use, and illustrate its temporal extent and practical importance. We pursue this aim in three steps, which give the outline of the remainder of the paper:

- *Participatory continuing design* aims to embrace the conditions for designing in use. We describe how use causes changes in, at least, the timing, object, process, outcome, and participants of design.
- *The case of videoconferencing in rehabilitation* illustrates how participatory continuing design has unfolded for two decades in relation to a single technology. The case description starts by introducing the research method.
- *Discussion* of the content and consequences of participatory continuing design to healthcare information systems. This discussion is based on the lessons learned in the case and provides recommendations for practical work.

We will not be presenting a full-fledged approach or method of participatory continuing design. In fact, it is central to our contribution that participatory continuing design defies methods and approaches, at least in the traditional sense, because it to a larger extent emerges than is deliberately planned.

1. Participatory Continuing Design

Ehn [5, p. 95] notes that “envisioned use is hardly the same as actual use, no matter how much participation there has been in the design process”. This statement acknowledges that use can only be imperfectly represented during design and, thereby, points to the need for continuing design in use to respond to the needs that do not emerge until the system is used for actual work. In addition, a system becomes salient to users only when it starts to affect their work and require them to change their work practices [6]. It is often not until this point that users start reacting to the system and become motivated to influence its design. That is, rather than a design process that ends before actual use can begin, “the boundary between design and use is permeable in that use, in some form, informs design just as design, in some form, continues during use” [7, p. 291]. The conditions for design are, however, different during use and necessitate that design takes on new forms. In the following, we describe five ways in which use changes design. These five ways concern the timing, object, process, outcome, and participants of design.

First, the timing is different. As already described participatory continuing design shifts the focus to the design activities that happen after the system has entered into ordinary use. This is in contrast to the many PD studies that focus on the early stages of design when requirements are being formulated and the system exists only as a non-

functional prototype [e.g., 8, 9, 10]. The shift in focus introduces a longer temporal perspective. While design projects normally have a temporal perspective of months or years, many systems are in use for years or decades and need to evolve during this period to remain useful. The long-term perspective of continuing design has been articulated in two related, but different, ways. Karasti et al. [11] discuss it in relation to the development of information infrastructures. The users saw the infrastructure as tightly coupled to their work and, in turn, saw the continued evolution of the infrastructure as tightly coupled to their possibilities for developing their ways of working. The users' temporal orientation of infrastructure time led to different prioritizations than the designers who had a temporal orientation of project time. Markus [12] distinguishes between IT projects and organizational change programs. While IT projects are "temporary", organizational change programs involve "continuous improvement" (pp. 10-11). In her technochange management approach Markus emphasizes that IT projects are but a means to organizational development, along with other means such as process restructuring, job redesign, adjustments in reward systems, and so forth. That is, the ultimate focus is on the longer temporal perspective.

Second, the object of design shifts from software toward services and work processes. The insight that systems are sociotechnical [13] is often taken to imply that the social and technical aspects should be developed in tandem. Participatory continuing design acknowledges that the possibilities for technical design will often be limited or absent during use and instead concerns itself with the rich possibilities for changing the ways in which systems are used and the services they are used to deliver. In this way, participatory continuing design resembles work on user participation in implementation [14] and differs from work on pilot implementation [15] because pilot implementations are performed before the technical design has been finalized and aim to provide input for changing both social and technical aspects of the design. Multiple studies find that users experiment with a newly introduced system for only a brief period of time, after which their use of the system becomes fixed [16]. A frequent reason for such fixation is lack of time for activities not directly related to progress on the primary work tasks. Participatory continuing design is about the, often unremarkable, design activities that can be incorporated in the day-to-day use of systems for primary work tasks.

Third, the process of continuing design differs from that of design at project time. During participatory continuing design the users "live with" the system. Living with the system is a metaphorical expression for using the system for actual work over an extended period of time, including reflective episodes through which use evolves. Reflective episodes arise out of practice and are responded to as part of practice. To facilitate sharing, reflective episodes are occasionally documented but they mostly spread gradually through demonstration on subsequent occasions. Triggers of reflective episodes include breakdowns but, more generally, the process of participatory continuing design presupposes an organizational capability of becoming and remaining aware of things, such as redesigns, that may be important – a collective mindfulness [17]. Collective mindfulness is difficult to sustain in the absence of a project organization with deadlines and milestones. Lacking the cognitive support structure of a project organization users in participatory continuing design are faced with additional uncertainty and ambiguity. The process of continuing design may be described as improvisational [18] in that it responds to emergent insights and possibilities to a much larger extent than it relies on planning and specification. Through its focus on emergent

insights and possibilities participatory continuing design complements design at project time, which favors planned change including the subset of emergent changes that can be brought out in workshops ahead of actual use.

Fourth, the outcome of design changes from requirements specifications and software functionality to working configurations. Henderson and Kyng [4] emphasized the need for systems to be configurable so that users could fit their technological environments to local and evolving needs. Such technical configurability was, for example, utilized by the employees of a labor inspection agency to make templates for recurrent tasks [19]. Through participatory continuing design the templates gradually evolved from tools for individual use to formally reviewed templates that served to institute organization-wide standards. To establish a working configuration the users must configure technical components, enroll colleagues, devise procedures, standardize intermediate work products, and keep the parts aligned in the presence of the particulars of day-to-day operations. The whole assemblage of parts must be configured, not just the technology [20]. It is complicated to obtain, sustain, and evolve a working configuration and, at least partially for that reason, the initial vision and intentions of a system are only transformed slowly during use [21].

Fifth, the participants change, and so do the conditions for their participation. The nature of the users' participation in design projects is a core theme in PD [22, 23]. Often the focus on genuine participation, in which users become co-designers, is used to distinguish PD from design approaches that merely consult the users or involve them as informants [24]. While the focus on genuine participation aims to ensure user influence on decisions about their work, it is based on an assumption that design happens away from the users' day-to-day work. In contrast, genuine user participation is inherent in participatory continuing design because it happens during the users' day-to-day work and is performed by the users. What is, instead, an issue in participatory continuing design is the frequent absence of designers. Light and Akama [25] make the case that all actors involved in designing, including the professional designers, should care about providing the users with the opportunity to influence their lives. The obligation to care about this opportunity is a long-term commitment, as emphasized by the focus of their study on designing societal relations. From this point of view the infrequent participation of designers in participatory continuing design is not just a practical limitation for the users; it also involves an ethical issue for the designers. Proposals for facilitating continuing interaction between users and designers include shop floor IT management [3], which turns the continuing design of systems into a recognized work activity, co-realization [26], which moves designers into the context of use for extended periods of time, and PD in use [27], which embeds a tool for user-designer communication in the user interface of systems.

2. Setting and Method

Sunnaas Rehabilitation Hospital provides specialized rehabilitation services for Norwegians with spinal cord injury, serious burns, neurological diseases, traumatic brain injury, stroke, and multi-trauma conditions. With 159 beds, 3000 annual admissions, and 4500 annual outpatient consultations the hospital is one of the largest specialized rehabilitation hospitals in Europe. For most of the patients rehabilitation involves an initial hospitalization followed by a long-term, and sometimes life-long, relationship between the patient and a cross-disciplinary team of care workers. The

follow-up activities involve extensive collaboration with the local welfare agencies in the patient's municipality. In this collaboration the travel distances may be large because the hospital receives patients from all over Norway, though the majority of the patients are regional. Many of the patients have reduced mobility and may need special transport assistance, so that even short-distance travel can be exhausting. In addition, traveling to the hospital for meetings and patient assessments is time-consuming for the municipal care workers. For these reasons the hospital has worked systematically to introduce videoconferencing as a medium for its communication with patients and municipal care workers.

The first author has collaborated with the hospital since 2006 through participation in several of the hospital's projects, either as researcher or as a member of reference groups. The research has employed qualitative methods, mainly based on participant observations in project meetings and videoconferencing encounters, as well as interviews with project participants. The second and third authors are employees of the hospital and have worked as members of the hospital's telemedicine team (to be further described later). Their work has included training, problem solving and practical facilitation of videoconferencing, as well as project application writing, project management, and internal and external processes of negotiations and resource mobilization. The paper also builds on the research conducted for the second author's Master thesis, which was a retrospective analysis of the process of introducing videoconferencing at the hospital, based on archival studies and ten interviews with central participants [28]. The fourth author's role relates to examining the extensive and longitudinal empirical case with the analytic lens of continuing PD, based on a guest researcher visit in the spring of 2016.

3. Case: Videoconferencing in Rehabilitation

We present the case in three separate sections that roughly correspond to three time periods (see Figure 1). The first period was characterized by feasibility studies in the form of standalone projects. Later, the attention was devoted to how to scale and routinize the use of videoconferencing technologies across the hospital. This involved the establishment of an organizational infrastructure that could facilitate ongoing innovation in usage, as we describe in the third section.

3.1. Initial experimentation (1993 – 2007)

From the early 1990s individual specialists at the hospital had experimented with telemedicine in the form of videoconferencing.

Through funding from national programs and government, several exploratory projects were conducted, for instance on how to conduct neuro-psychological assessments via videoconference. The motivation for these projects was to improve patient services and enable the effective exchange of information and knowledge. While not sustained as services, these early project activities were crucial for the later routinization of services through spreading awareness among staff and management, as well as ensuring the establishment of an initial and gradually expanding technical infrastructure of network connections and videoconferencing rooms with the necessary equipment. In the start, the network was ISDN with a capacity of 128-384 kbps. In the early 2000s the hospital joined the regional IP network, which later merged with other

networks into the Norwegian Health Network, but the hospital kept some ISDN connections because the ISDN gateway functionality was limited in the Norwegian Health Network. The videoconferencing technologies used were picture telephones as well as video codecs based on the H.263 protocol. These were used for administrative meetings because the hospital had geographically separated locations, for educational purposes, and for meetings among the various professional groups. Occasionally it was also used for project meetings and – of special interest here – for competence transfer to the local rehabilitation team in patient pre-discharge meetings.

	Management	Initial experimentation (1993 – 2007)	Videoconferencing as a routine service (2008 – 2010)	Further development of new services (2010 – 2016)
	<ul style="list-style-type: none"> Project applications Engineers at Sunnaas' school and projects New VC services Full-time telemedicine position established VC room working group headed by the Chief Medical Officer Investment in VC rooms 	<ul style="list-style-type: none"> Technical infrastructure continually expanded Telemedicine team established Super-user organization established Network for handling collaboration issues reorganized VC rooms closer to clinics 	<ul style="list-style-type: none"> Telemedicine services in hospital strategy Annual budget for expansion of the technical infrastructure Reorganization of telemedicine service management One team coordinator in each clinical department 	
	Clinicians	<ul style="list-style-type: none"> Project leaders VC-supported collaboration between hospital sites VC-supported national and international collaboration Cost-benefit analysis 	<ul style="list-style-type: none"> Team coordinators adjust use of VC during their daily activities Extensive training program Standardized user guides Agreement with NAV Easier booking of VC meetings New VC services developed Bridging technical-clinical barriers 	<ul style="list-style-type: none"> The role of team coordinator formalized Cost-benefit analysis that showed large benefits More projects and new services

Figure 1. Timeline for the participatory continuing design of videoconferencing (VC) at the hospital.

A more comprehensive project running from 2005 to 2006 addressed the need for more routinized and widespread clinical services. The aim of this project was to develop and establish new services in the transfer of patients between the hospital and the municipal level. Thus, the project explicitly aimed at both innovation and routinization of services. At this time few of the participating municipalities and hospitals had appropriate infrastructures to establish such services. In spite of the lack of infrastructures, several new usage areas were tried out and evaluated, and a cost-benefit analysis of these services was made. The results varied across the various services analyzed, but in general they showed a net benefit for society, although not for the hospital because reimbursement fees were not defined for these services. The documentation of potential socio-economic benefits of the services carried a significant discursive power in later negotiation processes. In 2007 the hospital management decided to introduce a full-time position with responsibility for telemedicine, establish a working group for the design and placement of videoconferencing rooms headed by the Chief Medical Officer, and equip two new videoconferencing rooms located closer to the clinics.

3.2. Videoconferencing as a routine service (2008 – 2010)

Between 2008 and 2010 a project explicitly aiming at the routinization of telemedicine was carried out. When this started, videoconferencing was mainly used for administrative and educational purposes though some departments also used it for communication about individual patients, mostly to communicate with collaborators in the municipalities.

The project funded a project manager (external) and a part-time internal coordinator. The other participants in the project received no economic compensation and had to find time for the project in their daily work schedule. There were participants from all clinical departments; most of them were team coordinators. This role implies the main responsibility for the patients at the hospital and for the communication and collaboration with the many actors in addition to the patients. The team coordinators thus have an extensive understanding and overview of the complex work processes and are able to coordinate and connect the right people at the right time in the patient's rehabilitation process. The work processes in the clinical departments varied a lot. For instance, the purpose and length of the hospital stay could vary from many months for rehabilitation to shorter but repeated stays throughout the patients' lifetime. Some encounters lasted only a day or a few hours, for assessment purposes (e.g., assessments for driver's license, new equipment, and work potential). Initially, none of the departments mentioned the use of videoconferencing in their formal procedures.

One of the first projects was to revise the formal procedure for patient discharge. The change was not radical; the only thing to change was to add a requirement that for every patient discharge, the responsible person should consider whether the use of videoconferencing during the discharge process would be feasible in this particular case. If videoconferencing was considered feasible, the patient agreed, and a local videoconferencing room could be found not too far away from the patient's home municipality, then a videoconference was set up. A "telemedicine team" with responsibility for the maintenance, development, and sustainability of the new service was formed. The team was responsible for technical support and established a hotline to solve problems related to videoconferencing. Because the team consisted of one physiotherapist and two technicians (including the second and third author), it was able to bridge the technical-clinical barrier.

An extensive training program was conducted across the organization. This resulted in a seven-fold increase in videoconferencing hours during 2008 and an even steeper two and a half times monthly increase during 2009. Joint staff meetings were held to inform about the project and the new services, and the staff received hands-on videoconferencing training, given by healthcare workers rather than technicians, either from the telemedicine team or from super users. The training aimed to reach all staff and was offered to one department at a time, and also as regular "refresher" sessions where individuals could drop in. Standardized user guides and similar interfaces were created for the videoconferencing rooms. The sharing of individual success stories was important in mobilizing new participants. For instance, a team of physical therapists and speech therapists at the hospital guided a care team in a municipality in the training of a patient to eat orally after having received tube feeding for 13 years. This story reached the national newspapers. One of the most frequent videoconference activities was meetings (Figure 2, left) but the videoconferencing facilities were also used for patient consultations. In the consultation in Figure 2 (right) the patient and therapist

could talk directly to the responsible person at the Norwegian Labor and Welfare Administration (NAV) and discuss the preparations before returning home. This allowed a larger degree of interactivity and involvement than the conventional process, in which hospital staff, in collaboration with the patient, would fill out a number of forms and send them to NAV. In another meeting, hospital staff and several persons from NAV communicated with local healthcare staff, who were present in the patient's home. The laptop was moved around in the house and gave everyone an immediate, visual sense of the barriers (doors, steps, etc.) that had to be removed before the patient could return home. The joint discussions possible in the meeting enabled a speedier decision-making process than was usual.



Figure 2. Videoconferencing meeting in clinic (left). Therapist and patient in dialog with NAV (right).

In project meetings, the project leader and the coordinator often both participated via videoconferencing, thereby demonstrating its feasibility in practice. The departments gradually started to use the new procedures. Different needs and possibilities were encountered, and the departments negotiated how and when videoconferencing should be implemented as part of their routine clinical service. Some services were tried and then discontinued, either for economic or clinical reasons. Three departments started up in the spring of 2008, three more in the autumn, one in the next spring, and the last one in the autumn of 2009. Departments that had team coordinators performed better than those with no team coordinator, and after the project all clinical departments were reorganized to have team coordinators, who also became super users for the videoconferencing solution. At the end of the project period, in 2010, almost all clinical departments had integrated the new model for service provision with extensive use of videoconferencing. The videoconferencing activities were based on existing, already available equipment. However, in parallel with the increased use of videoconferencing the technical infrastructure was expanded, replaced, and upgraded through regular organizational processes.

It was a challenge that the municipalities and other collaborating hospitals had limited access to videoconferencing rooms. However, the project leader learnt that videoconferencing equipment was being rolled out to nearly all NAV offices, which were located in the municipalities. She reached a nation-wide agreement with NAV that allowed local health workers free access to NAV's videoconferencing rooms with all facilities included (such as testing the video connection two days ahead and guiding participants in how to use the videoconferencing equipment). This was a significant boost for the telemedicine activities.

3.3. Further development of new services (2010 – 2016)

The reorganization of the network for handling collaboration issues and the formalization and extension of the role of team coordinator became important elements in the sustained expansion of telemedicine usage. The team coordinators constituted the super users of the videoconferencing service and met regularly in the coordinators' network, where telemedicine was a recurrent topic. They received requests and elicited needs from the clinical staff and patients in their daily work, and brought these to the attention of the telemedicine team. Some of these needs and requests triggered the development of additional services. For instance, a patient with a pressure ulcer who had the option of either being admitted long-term to the hospital or undergoing frequent and arduous transport to the outpatient clinic, asked his doctor: "Why can't you do the follow-up over Skype?" This triggered a process where a new project was initiated to offer video-based communication to patients' homes (Figure 3). For legal reasons this could not be done using Skype but required the use of another software client for videoconferencing in which the data stream was encrypted. The installation of this client on the users' laptop substantially expanded the services offered because it provided a cheap solution to participation in videoconferences from the patient's home. During earlier years, it had not been feasible to offer services in the patients' homes because dedicated hardware had been required. In the pilot project, online consultations between hospital staff, patients, and municipal home-care staff eliminated the need for the patient to travel to the hospital. This was initially a short-term project with limited funding, but the involved staff managed to mobilize additional resources, for example to facilitate a PhD study by a medical doctor on the clinical outcome of such follow-up. The service has now become institutionalized as a routine out-patient service for this group of patients.



Figure 3. Sunnaas staff in videoconference about pressure ulcers with a surgeon at Oslo University Hospital (left). Easier cooperation using PC-based videoconferencing with a patient at home (right).

The learning outcomes of this project in terms of, for example, appropriate organization also influenced attempts to establish similar services for other patient groups (such as home consultations for patients with 'locked-in' syndrome and aphasia). A second example of the requests emerging from the daily clinical work related to a patient who had been in isolation for a long time. The patient wished to participate in patient teaching sessions and to meet other patients at the hospital. The telemedicine team provided an iPad with a videoconference connection to the teaching room. Later, the patient also used the iPad and videoconferencing equipment to communicate with the staff outside of the isolation room. Such solutions become increasingly useful because still more patients show up with MRSA bacteria or other conditions that require isolation. The telemedicine team attempted to respond quickly to these requests and to

stay in close contact with the clinical staff who tried out new uses of videoconferencing. They saw it as their role to address technical, practical, organizational as well as content-related needs. To fulfil this role a close dialogue with the clinical staff was crucial because the clinical staff did not always see the technical potential for extended usage, while the technical staff did not always see the clinical potential of extended usage.

4. Discussion

Without the dedicated effort of many people over an extended period of time, the use of videoconferencing at Sunnaas Rehabilitation Hospital would most likely have remained limited and partial. The involved people include clinical, technical, and coordinative staff at the hospital as well as patients and staff in the organizations with which the hospital collaborates. These people did not develop the technology as such; rather the required work was to facilitate the incorporation of existing technology into evolving work processes. That is, they have continuously redesigned their work by tailoring technology, adapting work processes, and attending to local needs and constraints.

In the following discussion, we will revisit the five ways in which participatory continuing design differs from design before use – that is, timing, object, process, outcome, and participants – and provide recommendations about how to facilitate participatory continuing design.

4.1. Timing: a long-term perspective

The account we have presented of videoconferencing in rehabilitation stretches over more than 20 years, and the process of participatory continuing design is still ongoing in the hospital. The activities transcend the temporal frames of the various projects in this period and reflect the establishment of a more permanent, yet malleable, sociotechnical infrastructure. Without this infrastructure – the telemedicine team, the technical infrastructure, the broad organizational skill and awareness – the hospital would not have been able to utilize videoconferencing technologies and incorporate them into hospital processes. The infrastructure is, however, not the result of any single one of the projects or of a preconceived multi-project plan but the combined result of an improvisational effort. The guideposts in this effort have been the day-to-day accomplishment of the clinical work, in which the creation of the videoconferencing services has been firmly enmeshed. It has only been worthwhile to spend more than a decade on initial experimentation because the primary focus of the hospital staff has been the treatment of the patients, not the creation of the telemedicine services. Thus, the videoconferencing services have been established as needs, technologies, and organizational opportunities emerged and coincided.

While individual projects, such as providing access to videoconferencing for isolation patients, have had a specified focus and temporal duration, each of these projects has been conducted in the context of the overall commitment to videoconferencing. At times there have not been actual projects running or not been any dedicated staff, but the commitment to videoconferencing has still been there. It is the decision to make videoconferencing a technology in routine use across the hospital that introduces the long-term perspective and initiates the creation of the more permanent infrastructure for supporting videoconferencing. We abstain from

recommendations about how to make such decisions but offer two recommendations about facilitating a long-term perspective:

- Distinguish between time-boxed projects with specified goals and long-term commitments with room for evolution.
- Facilitate participatory continuing design with a sociotechnical infrastructure that provides resources and lends permanence to results across projects.

4.2. Object: an ecology of devices, support, linkages, and partners

The object of the participatory continuing design of videoconferencing included, but was not limited to, the need to assess, select, acquire, and use videoconferencing equipment. Keeping abreast with the technological developments in videoconferencing has been a challenge in terms of required knowledge, up-to-date equipment, as well as visions about what possibilities it affords. For example, the equipment and possibilities have evolved dramatically with the shifts in technical infrastructure from ISDN lines, over cabled broadband connections, to wireless networks. The object of the participatory continuing design has, however, also involved many other aspects, such as building a capacity in video-editing, instituting a room-booking system that was integrated with the email system, producing address books for the videoconferencing rooms, and so forth. To handle these aspects the hospital staff has worked with the national healthcare broadband provider (Norsk Helsenett), the regional health IT provider (Sykehuspartner), and many other external parties. For example, the municipal collaborators' limited access to videoconferencing rooms was handled by negotiating an arrangement with NAV to allow municipal healthcare teams to use NAV's local offices with videoconferencing equipment for their meetings.

To establish and sustain routine use of videoconferencing the various projects have also involved substantial work that targeted organizational structures and processes within the hospital. When the modes of usage expanded, new types of issues had to be approached and the need for organizational structures and processes increased. For example, when follow-up services for patients in their homes started, the telemedicine team needed structures and processes for purchasing software licenses for lightweight videoconferencing clients to install on patient laptops, for lending laptops to patient, for cleaning the laptops on return, and for supporting the patients' use of the laptops. Similarly, when starting to use tablets for videoconferencing within the hospital the staff created a need for upgrading the local wireless network, for establishing a regime to connect user IDs to the tablets, and for devising new norms for the places in which it was appropriate to have videoconferences. In total, the object of design constituted a heterogeneous ecology of devices, linkages, support, partners, and the various processes and arrangements that kept them aligned. We recommend:

- Enroll people with a mix of technical, processual, innovative, interpersonal, and organizational skills in participatory continuing design.
- Obtain commitment from hospital management to have its support in internal efforts and its mandate in negotiations with external partners.

4.3. Process: "living with" videoconferencing

The work with videoconferencing at the hospital defies a separation between design and use. Even during the first period – initial experimentation – the participatory

continuing design was performed by hospital staff and consisted of trying out videoconferencing in real clinical work. The second and third periods represent an even closer intermixing of design and use in that these periods established videoconferencing as a routine use activity in still more situations. Considerable design work has been accomplished and it has transformed the way the staff construes and conducts meetings. The intermixing of design and use has, however, made some of this design work appear rather unremarkable, or rendered it near invisible, because it has been subordinate to the clinical work and drawn out over long periods of time. Because needs and ideas emerged in use, the direction of the process was not preplanned. Rather, the team needed to be attentive to emerging needs, flexible with respect to changes in direction, and capable of resolving the salient issues no matter 'where' they belonged. While the constant presence of use has introduced here-and-now considerations in all design decisions, the overall commitment to videoconferencing has contributed opposing later-and-larger considerations. The absence of a preplanned direction of the design process presents obvious difficulties for informed later-and-larger considerations, and any such considerations stand in the way of quick fixes to pressing needs. Skill in merging these two sets of considerations is key to successful participatory continuing design. Consequently, we recommend:

- Incorporate design firmly in use, and vice versa, to ensure that design work stays relevant to user needs.
- Balance here-and-now against later-and-larger considerations in decisions about the direction and evolution of participatory continuing design work.

At the hospital a central strategy in ensuring due consideration of later-and-larger issues has been to rely completely on ready-made technologies and not engage in local technology development. This strategy has transferred part of the responsibility for later-and-larger issues to the companies that develop videoconferencing software, tablet hardware, and network standards. In areas of rapidly developing technologies this appears a necessary strategy because it will be impracticable to keep internally developed components compatible with externally purchased equipment over the useful lifespan – often decades – of the designed services.

4.4. Outcome: a working configuration

It is evident that the outcome of the participatory continuing design at the hospital is neither a videoconferencing room, nor an iPad for isolation patients. Not only is the outcome sociotechnical rather than merely technical, it is also a continuously produced collaborative accomplishment rather than an entity with an existence separate from the work at the hospital. The outcome is a working configuration, that is, an assemblage (of rehabilitation goals, configured technologies, work processes, competent people, organizational support, etc.) that exists in use. This working configuration is valued by the hospital, its collaborators, and patients because it eases their work and treatment. When the configuration is not in use or occasionally breaks down – when it is nonworking – then it becomes apparent that the value is attached to the working configuration. On this background it is easy to miss the point that it is an accomplishment to maintain a focus on the working configuration as the principal outcome of a design process. Many design processes take place as a precursor to use and, thus, before the work of creating a working configuration. Such design processes have limited opportunity to focus on working configurations and tend, instead, to make assumptions about them. Because participatory continuing design occurs during use it

is uniquely positioned to maintain the working configuration as its principal outcome. We offer two recommendations about how to bolster and utilize this position:

- Make discussions of the working configurations that are important to the clinical work a recurrent theme at meetings about the status of the patients.
- Perform small improvements at a time to avoid that the change effort becomes the focus and, thereby, moves the focus away from the working configuration.

The unique position of participatory continuing design is reinforced by the role of users as the core participants in participatory continuing design. The users of a design are those with the most immediate interest in incorporating it effectively and efficiently into their work and with the most detailed knowledge of this work. However, they are often also immersed in performing their work to the extent of having little time and attention left for rethinking it.

4.5. Participants: the facilitator role

The hospital's process of incorporating videoconferencing into the work practices has depended crucially on the existence of individuals who took on a facilitator role. They communicated with the hospital management and clinical departments to ensure buy-in, wrote project applications, and networked with relevant actors (e.g., with vendors to test out equipment). During experimentation with videoconferencing in clinical use, they provided hands-on videoconferencing training and a technical support hotline, which was crucial to ensure the trust of the clinical staff. In addition, the telemedicine team took care of crosscutting, infrastructural tasks that no single clinical department felt was their responsibility, for instance establishing a shared room-booking system in Outlook, harmonizing the user interface of all videoconferencing rooms, offering a video-editing service for the production of instructional videos, and making generic letters to inform patients and municipal collaborators about videoconferencing.

While there is no designer as such in the videoconferencing case, the process of participatory continuing design hinges on these facilitators who know the technology, the organization, and the clinical work. In addition to the telemedicine team, the facilitators include the super users and coordinators in the clinical departments. Their local presence in the departments facilitates the ongoing harvesting of ideas and requests from end users. The space for end users' participation is thus deeply integrated with collegial communities. We offer just one recommendation with respect to the participants:

- Form and nurse a team of committed facilitators; if such a team is not present then downscale expectations to participatory continuing design to a minimum.

5. Conclusion

We have explored the continuing, user-driven, participatory process of incorporating videoconferencing technology into the work processes and organization at Sunnaas Rehabilitation Hospital in Norway. We see this case as an instance of the adaptations and design-in-use that happen around information and communication technologies, and therefore of relevance also for healthcare information systems in general. After technologies have been adopted for use there is the need to continue to design the situated use of these technologies in the healthcare organization. This constitutes a

process of experimentation and learning, which is fundamentally dependent on the mobilization of the worker collective for incorporating the technology into practice, as well as the wider organization for adapting its structures. We have termed this process participatory continuing design, and we have illustrated how it differs from design-before-use along several dimensions – its timing, object, process, outcome, and participants. It is our hope that drawing the attention to the process of participatory continuing design may help managers attend to the conditions for supporting such designing in use.

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